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By

JOHN FRANCIS GIBBS BENT,

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" E P I L E P S Y . "

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62, Replingham Road,

Southfields,

L o n d o n, S. W.

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# EPILEPSY.

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## SYNONYMS.

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No useful purpose would be served by enumerating all the names by which epilepsy has been described, inasmuch as many of them have fallen into complete disuse; The following are the most important.

L'Epilepsie (French); Fallsucht (German); Epilepsia Mal Caduco (Italian); Epilepsin fallendsot (Scandinavian); Epilepsia, Epilepsis (Greek); Epileptica passis, Morbus sacer, Morbus comitalis, Morbus major, Morbus Herculeus, Morbus mensalis, Morbus convivialis. Morbus insputatis, Morbus viridellus vel vitriolatus, Morbus santicus, Morbus caducus, Morbus unicatus, Morbus foedus, Morbus sideratus vel astralis, Morbus scelestus, Morbus Deificus, Morbus doemoniacus, Passio caduca et perditio, Analepsia, Apoplexis parva (Latin).

## DEFINITION.

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Owing to the variety of opinion held regarding the nature of the disease a definition to coincide with

the views of the numerous writers on this protean, variable, and uncertain malady can scarcely be formulated. The writer believes the following will cover the essential phenomena of the disease.

Epilepsy is a condition affecting the brain characterized by recurrent paroxysms of sudden onset and variable duration, -the latter usually short - with impairment or loss of conscious<sup>s</sup><sub>^</sub>ness and a similar condition of motor coördination, with or without convulsions.

#### HISTORY.

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The writer believes himself justified in saying that there is probably no nervous disease which has been more extensively written upon - even in ancient times - than that under consideration. We find references to it as early as the tenth century, when it figured in the text of Avicennes. Hippocrates called it "Iepon nosema", or sacred malady, and "pathospaideion", or malady of children, believing that the attacks had their origin always in early infancy and never later. Plata and Aretaeus advanced the theory that the disease sprang from a thirst for gold, and equally absurd and unreasonable explanations are found in the writings of the fathers of medicine.

The older French writers were diligent investigators, but with them prevailed the tendency to explain the origin of the disease by mysticism, and among many it was supposed to bear some connection with the coming of St. John.

The popular humoral theory of the malady originated by Mercurialis was afterwards opposed by Averrhoes and Fernel, but for years afterwards found adherents. Bouchet and Causauviell maintained that the disease was inflammatory - a view that was vigorously combated by Bouilland and Dillasiauve. The theory of Broussais - which was and is the basis of the conclusions of modern investigators - is that it is dependent upon cerebral irritation. It is hardly necessary to refer to the many untenable and curious attempts that have been made to explain the pathology of the malady; suffice it to say that many of them were as extravagant as that of Vepper, who considered that the pineal gland was the seat of the affection - a conclusion in which Descartes coincided. Marshall Hall was the first writer to advance the theory of reflex irritation, believing that gastro-enteric or uterine irritation, acted upon the brain. In later years Schroeder Van der Kolk, Reynolds, and others have written quite fully upon the part played



by the medulla, while since then numerous French and German writers (Bourneville, Meynert, Sommers, Tagges, etc.) have attached much importance to the discovery of sclerosis of certain structures lying at the floor of the lateral ventricles. Hughlings-Jackson by his elaborate and exact researches as to cerebral localization has perhaps given the greatest impetus to our knowledge of epilepsy and opened up a new field of investigation in which workers since his day have indeed reaped a golden harvest, as the vast proportions of existing literature abundantly testifies.

#### GEOGRAPHICAL DISTRIBUTION.

Of all nervous diseases epilepsy none are so ubiquitous as epilepsy, and mention is made of it in all countries possessing a medical literature, or in which medical science has gained a footing. It may therefore, be said to prevail all over the world.

## ETIOLOGY.

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### HEREDITY.

That heredity plays a most important part in the genesis of epilepsy cannot be denied. Some writers have traced 50 per cent of their cases to some hereditary predisposition. Insanity, epilepsy, and pulmonary tuberculosis in ancestral history stamp their constitutional imprint upon the unfortunate descendant, and the histories of cases published from time to time in the medical press will show the extent of saturation that may exist in paternal or maternal branches and the evolution of this disease in male and female subjects.

Gowers found that in 1218 cases, 429, or 35 per cent, presented evidence of neurotic inheritance.

Echeverria estimated the proportion of hereditary cases at 28 per cent, while Reynolds fixes it at 31 per cent. The statistics of other writers are equally significant, and some show a larger proportion of cases with hereditary history than these. So far as the history of hereditary influence is known, it appears that females are more apt to present this form of epilepsy than males, and, according to Gowers's investigations, the transmission

comes from the mother's side more frequently than from the other. So far as the writer's enquiries have gone, he has found insanity more often among the progenitors of the epileptic than any other nervous disease, and in many cases pulmonary tuberculosis. He is inclined therefore, to give greater weight to this relationship than Nothnagel and others. Anstie, Bastian, Savage, and other authorities have pointed out not only the close connection between pulmonary tuberculosis and epilepsy, but between the former disease and migraine with the more serious convulsive affection.

It is long since dissimilar heredity was established as a factor in epileptics, and writers upon the subject mention hysteria, suicide, somnambulism chorea, general paralysis, etc., amongst the antecedents of the disease. Nothnagel, Hammond, Moreau de Tours, and others consider drunkenness as of important etiological significance. The frequent coexistence of these maladies in the same individual proves their relationship to the disease under consideration. Beau, Morel, Delasiauve, Lasèque and others, on the other hand maintain that similar heredity is extremely rare in epilepsy, and Louis goes so far as to deny it altogether. The older

writers mention it; and it, therefore, appears to be less frequent than the other form of heredity described.

Epilepsy may be directly or indirectly transmitted, i.e., it may be effected through ascendants or the collaterals. Echeverria and Bourneville believe that similar heredity is more frequently indirect. Atavistic heredity is often observed, the malady passing from the grandfather to the grandson without affecting the son. Sometimes it happens that epilepsy manifests itself at the same age in two successive generations (homochronous heredity); but usually anticipation occurs in the descendants, i.e. they are attacked at an earlier age than the ascendants. The disease may show itself in the son before its appearance in the father under such circumstances.

Trousseau and Boudin ascribe an important part to consanguinity as a congenital predisposing factor to epilepsy; morbid consanguinity may give rise to all sorts of degenerations and to epilepsy in particular, but that the same result would follow the marriage of kindred parents free from every pathological taint cannot be proved.

Among the causes affecting the ascendants may also be mentioned a disproportion in the age of the parents, especially a greater age of the mother.



Too early or too late unions have also been regarded as etiological. Besides family taints in the ascendants, there are acquired conditions which may be considered as important factors in the epilepsy of children, such as, for instance, poisoning by lead or mercury, acquired syphilis, and excesses. Still we should not consider as independent of every hereditary taint such voluntary intoxications as alcoholism and morphomania. Most of the patients in this category are impulsive and neuropathic. In certain cases the epilepsy of children can be traced back to absolutely temporary states in one or both of the parents, whether at the moment of conception or during gestation. Esquirol, Lucas, Morel and many other authors have dwelt on the influence of drunkenness at the moment of conception. Other predisposing factors are defective feeding, bad hygiene and infectious diseases of the parents. All these debilitating causes may act in the same way through the mother during pregnancy. Apart from every anterior neuropathic taint, emotions of the mother during that condition have been especially blamed; but it may be asked if the neuropathic state of the mother is not to be taken into account in cases cited in corroboration

of this opinion, for there were terrors produced by slight causes out of all proportion to the intensity of the emotions in nearly every instance. Be that as it may, that the foetus reacts strongly under the emotions of the mother and, therefore participates in her convulsive movements cannot be denied. In this connection the frequent existence of mental disturbances in subjects of illegitimate birth is suggestive.

The application of forceps, retention of the head for an inordinate time in the pelvis, and asphyxia from compression of the umbilical cord, are among the more or less problematic causes that have been advanced as capable of producing epilepsy in the infant either at the time of birth or during the first few weeks of life. The habit of placing the infant always on the same side (as likely to produce an obliquely oval deformity of the cranium) and the use of close fitting caps, in countries where they are still employed, are among the hygienic faults that have likewise been incriminated. Among other factors said to be predisposing, the influence of which it is often difficult to demonstrate positively, are, when the child is at the breast, defective hygiene, emotions and especially alcoholism in the

nurse.

Certain experiments would seem to prove that epilepsy can be transmitted from the parents to the descendants. Thus Brown-Séquard has shown that guinea-pigs, which have been artificially rendered epileptic, may give birth to young affected with convulsions.

#### AGE

All are agreed that epilepsy can occur at all ages-- from the first year to the seventieth (Reynolds) or the seventy-fifth (Heberden). Nothnagel and Echeverria affirm that after twenty years hereditary epilepsy is no longer to be feared, and Lasèque believes that true epilepsy can only appear between the fourteenth and twenty-eighth year of life. The former opinion is obviously erroneous, for we know now that epilepsy may supervene at an advanced age. Observers are agreed that the disease is far more common before the age of twenty than thereafter.

Gowers states that more than a quarter of all cases begin under the age of ten years; nearly half between ten and twenty; about a seventh between twenty and thirty; a sixth between thirty and forty; about 2.5 per cent. only between forty and fifty; 1 per cent. only between fifty and sixty; after that

only 0.5 per cent. Seventy four per cent of all his cases began under twenty. Gowers, analysing the number of cases for each year from 1 to 71, mentions that no less than 13.5 per cent. of the whole began during the first three years of life. In this group he includes no case of simple infantile convulsions, but only such as began in infancy and continued as chronic epilepsy. The number of cases is largest at the first year; falls rapidly to the third year of age, then more slowly until five, when for the entire period of life the minimum occurs. From this there is a considerable rise at seven, the commencement of the second dentition, then a fall at eight, from which the number increases slowly at nine and ten, rapidly at twelve until the maximum is reached at fifteen or sixteen, at which 166 and 167 cases occurred. From this time there is a rapid fall to twenty one, after which each year only a few cases were recorded.

#### SEX

Authorities differ as to the comparative frequency of epilepsy in the two sexes. In Gowers's cases 54.6 per cent. were males, and 54.4 per cent. females. On the whole females appear to be more affected about equally with males.



Hare (Epilepsy; Its Pathology and Treatment, p. 102) places little reliance on some of the figures presented by noted writers on this point; he places the greater number of cases among men.

Boyd among 145 cases found one-third more men than women.

Althaus (Diseases of the Nervous System, p. 122) in a collection of 54,000 cases found 28,690 males and 25,482 females.

Osler (The Principles and Practice of Medicine, 1902, p 1094) does not attribute to sex any etiological influence. (In his 433 cases, 232 were men and 203 were women.) After puberty, however, he considers men to be more liable than women.

Echeverria in 306 cases had 130 men and 176 women, but he believes the disproportion in the two sexes was due to some extent to the peculiarities of hospital accomodation.

#### RACE.

Epilepsy makes no distinction in its selection as regards race.

#### OCCUPATION.

The occupation of the individual, whatever its

nature exercises no predisposition to the disease. The fact of our finding the great majority of cases among representatives of certain callings is due to the relatively greater number engaged in such callings and not to the form of occupation itself exerting any specific influence.

### SYPHILIS.

Among the chronic diseases which are capable of causing epilepsy syphilis occupies an important place. In the secondary stage it may give rise to convulsive attacks independent of any known anatomical lesion. Sudden general attacks may supervene during this stage any may be observed to disappear under the influence of specific treatment. In other cases pre-existing epilepsy has been aggravated by syphilitic infection, and mercurial treatment has overcome this exacerbation. A person affected with syphilis may have a predisposition to epilepsy which manifests itself only at an advanced age, entirely independent of the syphilitic infection. Losing sight of the possibility of the tardy appearance of epilepsy Fournier has endeavoured to establish a parasymphitic epilepsy. to which however, he has been

unable to assign a single special characteristic. It is especially during the tertiary stage of syphilis<sup>i</sup> that epilepsy shows itself with particular frequency. It may then be dependent upon the most varied lesions, such as gumma of the brain, lesions of the cranial bones, of the meninges, of the cerebral vessels, etc. Syphilis is one of the oldest-established causes of epilepsy, and its cerebral lesions have received special study and description at the hands of Hughlings Jackson, Charcot, Buzzard, Fournier and others. It seems, however, that the existence of material lesions does not here exclude the influence of all neuropathic predisposition; for a large number of syphilitics suffering from epilepsy belong to neuropathic families. The cerebral localisation of the lesions is believed by many to be contributed to by overwork, physical or mental, and the struggle for existence.

#### TRAUMATISM.

This would appear to be<sup>a</sup> frequent and important etiological factor, and the head injuries may be recent, or remote. It is quite common to find old fractures, with depressions that have existed for years without any seeming bad effects, suddenly lighting up convulsions after the influence of some

new excitement. Under such circumstances the depressed bone is quite apt to give rise to symptoms suggestive of meningeal irritation and inflammation, so that the diagnosis is comparatively easy. Several observers have called attention to epilepsy which has been undoubtedly due to cicatrices not only of the scalp, but elsewhere, and these may or may not be found in association with osseous lesions. The literature of the subject is replete with curious cases which go to show that epilepsy may occur from a few days to many years - even twenty - after the initial head-injury. Unsuspected cortical pressure, the inner table being alone depressed, is common; in fact, the cases in which the most serious mischief is done seem to be those where the only external evidence of violence is the contused scalp. As a consequence of such injury exostoses may develop.

#### ALCOHOLISM.

Alcoholism of the chronic intoxications has perhaps been most suspected of the production of epilepsy. Chronic imbibition of alcohol acts undoubtedly by way of causing debility, and it may play a prominent part in heredity. But it is claimed as a fact that acute alcoholism is a powerful exciting factor



of an epileptic fit. It has not been proved that it may act upon ~~a~~ person free from every predisposition but it is a matter of daily observation in asylums that exacerbations of the attacks occur in epileptics after they have been permitted to go out. Some of these patients are so extremely susceptible that one or two glasses of wine suffice to bring back the paroxysms; rarely need they go as far as complete drunkenness. Maisonneure noted that drunkenness could reawaken an epilepsy which had been apparently cured for years. The fit may occur during the period of alcoholic excitement or it may be delayed until next day when the stage of depression appears.

#### ABSINTH.

Magnan (Recherches sur les Centres nerveux, Paris, 1876) and others describe absinthism as acting in the same way as alcoholism; but the proof has never been furnished that absinth is capable of exciting epileptic attacks in a person who is free from every nervous taint. The convulsions which have been caused in the lower animals by absinthe intoxication do not constitute a sufficient argument. Besides, the influence of this poison is very difficult to determine with precision in man, since those addicted

to it absorb nearly always a certain amount of alcohol with it. Cadeac and Meanier, of Lyons, state that the evil effects of this liquid are not due alike to all the essences which enter into its composition. The essence of anise in particular is of the greatest toxicity, but the essence of absinthe has little deleterious effect upon the human organism.

#### PLUMBISM.

According to many noted writers, epilepsy may be due to chronic lead poisoning. Leuret and others regard it as constituting a very favourable field for the development of the disease, and as a powerful exciting factor of nervous manifestations of every kind, and is said to frequently produce acute epilepsy in serial attacks with delirium, - the status epilepticus, - which may terminate in death. The writer whilst not doubting the power of this agency to excite toxic convulsive phenomena, believes that the comparative rarity of such intoxication makes it an infrequent cause of epilepsy.

#### TOBACCO.

Many cases appear in the literature which would seem to show that intense poisoning from nicotine is capable of undermining the system in certain individ-

uals rendering them more susceptible to epilepsy. Gowers tells of a boy whose epilepsy came on as the apparent result of frequent nausea caused by working in a tobacco factory.

#### OTHER TOXIC AGENTS.

Cocaine, ergot, opium, ether, chloroform, morphine, etc., have been cited as able to evoke an attack of epilepsy.

#### INFECTIOUS DISEASES.

The infectious diseases may in predisposed persons determine the starting point for epilepsy.

Scarlet fever seems to lead to epilepsy more than any other, and does so mainly by its renal complications.

Whooping-cough has been proved to be etiological in a certain number of cases. In view of the severity and frequency of pertussis it is surprising that it is not more often the cause of epilepsy; for the brains of children dying during the paroxysm of coughing are found engorged with blood.

Among the other conditions of this class to which epilepsy has been ascribed are; enterica, typhus, yellow fever, malaria, diphtheria, insolation, pneumonia, measles, meningitis, and influenza.

EMOTIONAL SHOCK.

An epileptic fit can undoubtedly be proved in predisposed persons by a more or less intense shock of the nervous system, such as grief, fear, and prolonged anxiety. These physical states, moreover, are associated with an overexcitability which is very favourable to the evolution of convulsive phenomena. At the menstrual periods these emotions act more powerfully by reason of the nervous susceptibility which accompanies this physiological condition. The convulsive discharge sometimes follows immediately after the emotion has been experienced, but this is not always the case. The nervous depression succeeding emotional shocks may last for some time, and the attack may supervene during the asthenic state, occasionally long after the initial cause. An epilepsy which manifests itself in connection with some fright may become definitely established and the fits may thereafter appear without apparent exciting cause. In other instances the attack occurs invariably when the same exciting influence is reapplied; for instance, the sight of a dead body, of a precipice, of blood from injury, etc. Sometimes, however, the fright is merely the prelude of the attack, and it is only the result of terrifying visual hallucination which is a part of the aura. Thus the patient thinks perhaps that he sees a waggon rapidly driven towards him; the



fear of being run over makes him fall uncon<sup>s</sup>cious;  
 but nothing in reality corresponds to this vision.  
 The emotion is really a part of the paroxysm, but the  
 patient remembers it and blames it for the attack.  
 In the same way nightmares have been incriminated  
 as causing nocturnal attacks.

#### NASTURBATION.

It is a matter of great difficulty to estimate the  
 number of cases of epilepsy due to this cause; it is  
 a popular etiological factor. The writer does not  
 believe, even in the face of the numerous alleged  
 cases that have been recorded, that the habit of  
 self-abuse often results in genuine epilepsy. So  
 far as can be ascertained, onanism is practiced by  
 epileptics as well as by healthy boys, and when  
 indulged in is due to the congenital moral deficiency  
 which is so common, especially in hereditary cases.  
 The oft-repeated act may however, give rise to a  
 form of the disease, of the nature of the petit mal,  
 in rare instances.

While the writer does not place much reliance on  
 the claims that have been made regarding the frequent  
 dependence of epilepsy upon preputial irritation,

or that it may arise from PHYMOSIS or urethral STRICTURE, he does not deny that some cases have originated in difficulties of the kind, and especially the former. Disease of the TESTICLES in certain cases plays a part in its genesis, and Liégey (Gaz. med du Strasburg, 1856, xvi, 105-107) describes an epilepsy apparently due to testicular PRESSURE. The alleged sexual causes are many, and some of them very doubtful. Voisin dilates at length upon the abuse of COITUS as a determining cause of epilepsy. Some epileptics have fallen into a fit during the act or soon afterwards.

#### VESICAL CALCULUS.

This must be a rare cause of epilepsy; still the observations of Duncan (Edin. Med. Jour., 1868-69, xiv, 9), Muscroft (Arch. Sci. and Pract. Med. and Surg., 1873. 1360), and one or two others, have shown that the removal of a stone was followed by a cure of the epileptic condition.

#### GASTRIC DISORDERS.

Many writers dwell upon these, and especially Paget, who speaks of a gastric epilepsy and reports cases. While the writer does not believe in the sole

etiological influence of digestive derangement, he has witnessed examples in which disorders of this kind markedly influenced the precipitation of attacks and the duration of the malady.

#### DENTITION.

Most writers are agreed that epilepsy may appear in connection with dental disturbance. The frequency of convulsions in young infants is well known. The opinions of physicians who confine their attention entirely to diseases of children, and who have had a large experience therein may be taken as valuable testimony. Gowers believes that many cases of epilepsy date from infantile convulsions, and has observed that in many of them the first fits occur during retarded dentition, commonly with other indications of rickets, as definite convulsions, or as minor attacks, these persisting to puberty, to become decidedly epileptiform thereafter. This suggests that the early convulsions produce a lasting modification of the brain, and one which facilitates the tendency to discharge at the developmental epoch. Gowers remarks that some such influence must be ascribed to infantile convulsions in about one-tenth of the total number of cases of epilepsy; that

the popular connection of these fits with the process of teething has probably very slight foundation in fact; a slight local irritation may have an exciting influence, the general retardation of development being, however, the chief factor,

Holt (Diseases of Infancy and Childhood, 1900, p. 243) states that in spite of his former opinions to the contrary he now admits that dentition may produce reflex symptoms sometimes of a serious character.

Clouston, of Edinburgh, affirms that he has seen convulsions due to dentition followed by prolonged delirium ending in true epilepsy.

Jacobi is of the opinion that every convulsion, ever so slight or short, may produce haemorrhage within the cranial cavity with epilepsy.

Voisin (L'épilepsie, 1897, p. 23) says that epilepsy is above all the malady of infancy; that it makes its first appearance at birth, but generally it is at the moment of dentition that the first manifestations present themselves; in these cases dentition is the key-note of the hereditary predisposition.

Supported by opinions such as those cited, the



writer affirms that difficult dentition excites reflex convulsions which in time merge into true epilepsy, when acting upon an individual suffering from inherited constitutional diseases such as rickets, tuberculosis, insanity, epilepsy and alcoholism.

#### IMITATION.

Watson (practice of Physic) believes that the sight of a person in a fit is capable of throwing an onlooker into a similar condition, and considers it possible that this may be due to imitation, or to feigning, or to hysteria.

He does not doubt the epileptic nature of the induced phenomena. He emphasises the frequency with which patients who have already had epilepsy will fall into a convulsion at the sight of another one; and affirms that those not previously affected may acquire the disease in this way; and even that the disease will now and then run through a boarding school or through the ward of a hospital.

#### KIDNEY DISEASE.

In diseases of the kidneys complicated with uraemia the convulsions are attributed to a poison circulating in the blood as exerting an irritant

action upon the central nervous system; but one may ask if this is not simply an exciting cause acting upon a neuropathic subject who is predisposed to cerebrospinal reactions. Indeed, the varied clinical forms of uraemia would lead us to suppose that since all persons do not react alike to the same blood alteration they must present different organic predispositions. Convulsive attack in uraemic poisoning may develop without a warning or be preceded by such symptoms as pain in the head, restlessness, and malaise:

Osler (Practice of Medicine, 1895) affirms that such convulsions may be general and identical in character with those of true epilepsy, except as regards the epileptic cry. Furthermore, they may occur in rapid succession, the patient being unconscious during the intervals between the paroxysms, and the temperature subnormal. When the convulsions of uraemia are followed by hemiplegia, or monoplegia established, organic epilepsy may be the result.

#### MENSTRUAL DISORDERS.

Nearly all observers are agreed that disorders of menstruation may produce numerous neuroses to which epilepsy is perhaps the chief. Voisin and Gowers

have shown that the menstrual function coincides with an exacerbation of the fits in epilepsy, and progresses from thence in a markedly periodic form.

Voisin, indeed, goes the length of saying that menstruation<sup>u</sup> is the "signal of explosion of epileptic attacks"; in at least a quarter of his patients this was the case. Epilepsy may also appear or become aggravated by the onset of dysmenorrhoea or suppression of the menses. Somers tells of an epileptic patient treated by perforation of the hy<sup>m</sup>en<sup>Λ</sup> that prevented the evacuation of the flow after which convulsions ceased. The nervous system in such cases is doubtless poisoned by absorption of the retained menses becoming septic.

The MENOPANSE has often been inculcated, but it appears only to be effective in predisposed subjects, and is rarely an etiological factor as epilepsy is a disease of early life chiefly.

#### PREGNANCY AND MATERNITY.

Epilepsy occurs far oftener during pregnancy or the puerperium than at the menopause. Gowers describes ten cases in which the first fit occurred without obvious cause during pregnancy, and five during the

perium. The influence of pregnancy upon epilepsy appears to be extremely variable. Sometimes it induces the appearance of attacks which do not recur after delivery. At other times it aggravates the pre-existing disease, but the exacerbation is merely temporary. In a certain number of cases, however, the aggravation of the disease persists after the puerperium. On the other hand, cases have been reported in which the influence of pregnancy was favourable. Thus the fits have been observed to become milder and less frequent during gestation and this improvement has persisted indefinitely. In rare instances pregnancy seems to have suppressed the attacks, which never again recurred.

According to Hirst (Pregnancy, Labour, and other Puerperal states, 1896), epilepsy is a rare complication of pregnancy and as a rule, does not influence unfavourably the course of gestation; the convulsions are often absent during pregnancy, but make their appearance again during and after the puerperium, or upon the appearance of menstruation after the child is weaned. Some obstetricians attach considerable importance to the influence of phlegmasia alba dolens at this period, and affirm that the clot may be



carried to the brain, or the cerebrum may be poisoned by the general septicaemic state or reflex convulsions may be induced by the local inflammation itself. Evans has described facial neuralgia among other epileptic disturbances than convulsions which sometimes occur during ~~the~~ pregnancy. Epilepsy due to pregnancy or maternity is apt to assume a very serious aspect. One should, however, avoid falling into the common error of designating as eclampsia all the convulsions which are manifested at the time of parturition. Hysteria is likewise frequently called forth at this moment, and in this way one may account for the benignancy of certain morbid states which are called eclamptic and when the convulsive crises have been numerous are even accompanied by elevation of temperature.

#### ELECTRIC SHOCKS.

An epileptic attack has been induced by a shock of electricity, the subject of same being already a sufferer or bearing a predisposition to the malady.

#### HEART DISEASE.

Apart from the frequency of heart trouble - functional and organic - in epilepsy, there are

the cases in which cardiac lesion precedes and, in all probability, causes the epilepsy. Such cases are, however, rare, and mostly occur late in life, very rarely in childhood. They are most often seen in old men and usually in association with athermatous changes.

#### SLEEP.

Voisin states that among the determining causes of epileptic convulsions, sleep is without doubt the most frequent. He mentions the fact that all writers agree on this subject; and also that Lesague was so much convinced that sleep was, so to speak, a component part of the epileptic attack that he expressed the opinion that any nocturnal convulsive attack was of epileptic origin.

#### HYDROCEPHALUS.

Jacobi mentions that he has seen cases of epilepsy of later years due in great part to the compression of an originally normal brain in an abnormally compact and uniformly contracted skull; but more are due to, or connected with, a premature partial synostosis, it is the fate of many epileptics to have a comparatively small cranial circumference and an

absolutely asymmetrical shape.

#### FOCAL LESIONS OF THE BRAIN.

General or partial epilepsy constitutes one of the fundamental symptoms of cerebral tumours - syphilitic gummata, tubercles, various neoplasms, exostoses, abscesses, atrophy, <sup>1</sup>sclerosis, etc. The predisposition which can be traced in addition to the predominating causes enumerated seem here less essential; still it is certain that lesions of the same nature and similarly located are accompanied by convulsions in one case and not in another. Sometimes the lesion itself seems merely to create a tendency to the disease, and the epilepsy supervenes only in connection with some moral or physical shock. Thus Gowers describes the case of a child in perfect health who swallowed a lead pencil; some hours afterwards it had a severe epileptic fit; two months later it died and a glioma was found in the pons Varolii.

#### EYE STRAIN.

It seems certain that errors of refraction, necessitating as they do efforts of accommodation, may cause epilepsy. The point has however been long

debated; Stevens (Functional nervous diseases; Prize Essay, Royal Academy of Medicine of Belgium, 1883) describes the ocular conditions in 140 cases of epilepsy, and concluded that the general results of these examinations have been to demonstrate the existence of refractive anomalies in a considerably greater proportion than has been found by other observers in their examinations of the eyes of school children. Stevens, in 100 consecutive cases, found hypermetropia, with hypermetropic astigmatism in 59; myopia with myopic astigmatism in 23; and emmetropia, or refractive errors less than one dioptrre, in 18.

He claims, therefore, that errors of refraction producing eye-strain, are potent factors in the causation of epilepsy. It is interesting to note that Ranney (New York Med. Jour, Nov. 22, 1902) has markedly benefited epileptics by treating the ocular anomalies alone. Others - particularly Gould (American Medicine, vol. lv, No. 1. p, 2, July 5, 1902) report similar experiences.

#### WORMS.

Among the eccentric causes of epilepsy have been mentioned intestinal worms, but the writer is convinced that it is too often the fashion to ascribe



convulsions in children to intestinal parasites; in very young children, however, there are frequent examples of the disease in which the attacks are precipitated by worms. The fits are usually very severe, and not regular in their appearance, occurring at night-time more often than during the day, and, though they usually disappear when the bowels are cleared of their irritating occupants, may recur when once initiated, even though anthelmintics of the most powerful kind are employed.

#### GALL STONES.

These are mentioned by Ross as another eccentric cause of the disease, but the writer has never seen a case of this nature.

#### CARIOUS TEETH.

Baly (Lond. Med. Gaz. 1851, xlviii, 534-540), Booth (Amer. Jour. Med. Sci., 1870, N.S., lix, 278), and numerous others, have reported cases of epilepsy due to carious teeth. A wisdom tooth, for instance has been known to produce such violent inflammation that otitis media followed, and with it subsequent extension to the brain has occurred.

#### EPILEPTOGENIC ZONES.

For a variable period the morbid predisposition

may remain in a latent state, when it suddenly shows itself after an apparently insignificant cause, such as indigestion or an affection of the ear. It seems that there is in cases of this kind an epileptogenic zone which varies in each individual, but whose irritation is usually sufficient to produce an epileptic fit. Thus the attack has sometimes followed wounds of nerves. It was by irritating or cutting the sciatic nerve that Brown-Séquard was able to render guinea-pigs epileptic.

Certain painful irritations such as neuromata seem to have been the cause of convulsive attacks in man. In confirmation of this view it is a fact that the attacks ceased after the extirpation of the cicatrix or the tumour. When traumatic lesions of a nerve are present, sometimes a very slight irritation of the skin, either in the distribution of the nerve or elsewhere, suffices to bring on an attack. Thus it has been observed that pinching of the skin over an inflamed sciatic nerve was enough to throw the patient into an epileptic fit. Such cutaneous epileptogenic zones may be present in trigeminal<sup>n</sup> neuralgia at the level of the painful spots. Furthermore the existence of epileptogenic zones on the surface of the body, aside from any local or distant nerve lesion,

has been described, mere contact of such zones being sufficient to produce a fit. They have been discovered chiefly on the skin of the neck and hand, on the head, the temple, the alae nasi, the lips, and about the internal canthi of the eye.

#### AURAL AFFECTIONS.

Disease of the internal ear or injury of the temporal bone has been known to give rise to the most obstinate and violent epileptic seizures. Westmoreland (Atlanta Med. and Surg. Jour. 1876-77, xiv, 717-719) and others have reported such cases, but more often the epilepsy is only symptomatic of pachymeningitis or abscess. Cases have even been described in which the seizure was produced at will by irritating the auditory meatus, or by blowing into it.

Epileptic fits are particularly prone to result from irritation of the auditory nerve. They may be caused by the presence of foreign bodies or insects in the external auditory meatus. According to Magnin and Nocard, epilepsy in dogs is often due to the presence of worms in this canal. Here cure usually follows the extraction of the foreign bodies. Still the disease may persist when consecutive lesions of the ear have developed. Auricular epilepsy is often met

with in consequence of ordinary inflammatory lesions of the auditory canal and the Eustachian tube. Chronic otitis may be complicated with convulsive attacks, and these may disappear with the lesion. All forms of paroxysms are observed in consequence of lesions of the ear; vertiginous attacks however, are most frequent. Indeed, if the predisposition in patients suffering from auricular vertigo were inquired after it would often be found.

#### DISEASE OF THE RESPIRATORY ORGANS.

Borie and others have traced the origin of epilepsy to lesions of these parts, such as laryngitis, traumatism of the larynx, and pulmonary affections, especially those of the pleura. Convulsive attacks have also followed operations upon the latter membrane.

#### SPINAL LESIONS.

Lesions of the spinal cord have been described as producing epilepsy. Brown-Sequard's experiments in this connection are well known. He was able to produce the disease in guinea-pigs after complete transverse section of the posterior columns and of the posterior horns of the cord, as well as by division of the lateral or anterior columns, and simple puncture.



Irritation of epileptogenic zones of the face and neck likewise induced convulsions.

A number of cases have been observed in man in which epilepsy was due to compression of the cord by traumatism, by a tumour, and by some vertebral affection. Chipault mentions that an infant suffering from Pott's disease began to have epileptiform attacks from the moment that the cerebrospinal fluid escaped from a fistulous opening.

Brown-Séquard a different condition under the name of spinal epilepsy, which manifests itself when the continuity of the cord is broken in one of its halves. It consists of clonic and tonic convulsions, usually excited by cold, friction of the muscles and cutaneous irritations, but they are sometimes very violent when arising spontaneously. In the same category has been described (Charcot, Vulpian) epileptoid tremor which occurs in slow compression of the cord, anyotrophic lateral sclerosis, hemiplegia with contraction, hypertrophic cervical pachymeningitis and in other affections characterised by secondary or primary degeneration of the lateral columns of the spinal cord.

#### CLIMATE AND SEASON.

Delasiauve has studied the influence of climate and

barometric pressure. His conclusion was that during the season of the year when the prevailing winds were from the North-west, north, or south-west attacks of epilepsy are most frequent.

PATHOLOGY AND MORBID ANATOMY.

The experiments of many of the early writers were directed for the purpose of ascertaining the relation of circulatory variations to convulsive seizures, and the most notable were those of Burrows and Kussmaul and Tenner. The latter produced compression of the carotid arteries and instituted cerebral anaemia by free and exhausting haemorrhages. As a consequence, the emptying of the cerebral vessels was followed by a loss of consciousness and by epileptiform convulsions, and it was necessary to produce the same result to compress all the great different vessels of the brain. The experience of surgeons generally is, that ligation of the common carotid artery upon one side of the neck is sometimes very apt to produce an alarming anaemia, with occasional convulsions, the same being sometimes fatal.

Hall, Laudois, Herman, and others, as well as Sir Astley Cooper, Kussmaul and Tenner, Brown Séquard, Nothnagel, Schroeder Van der Kolk. Pitres, and Hughlings-Jackson, have shown by experiment that carotid compression results in capillary anaemia and venous hyperaemia, and that with cessation of this

pressure there is a sudden congestion of all vessels. The susceptibility of the brain is greatest at its posterior part and between the optic thalami and the cord. When the bulb was subjected to sudden changes in its nutrition - such, for instance, as followed the experiments of Hermann, who ligated simultaneously the superior and inferior venal cavae of a rabbit - there was not only convulsions, but various cardiac and other disturbances which were undoubtedly due to central impairment of function. Kussmaul and Tenner conducted their experiments with watch-glasses luted into the cranium - at best an <sup>un</sup>reliable procedure.

Later Brown-Sequard in part established the theory of epileptic zones, and demonstrated that bruising and injury of the great nerve trunks, especially the great sciatic, would give rise to epilepsy, and that irritation of certain tracts would precipitate the paroxysms. He further announced that the progeny of animals in whom epilepsy has been thus induced very frequently inherited the epilepsy of the parent. By some it was held that such epilepsies were purely peripheral, and Brown Sequard believed in spinal epilepsy. His spinal epilepsy theory Hitzig has endeavoured, by anatomical observations, to explain



away with the doctrine of interrupted spinal inhibition, many spinal epilepsies being examples of exaggerated reflexes only. The epileptogenic zone theory, which, while it induced many to believe that the disease may have its origin outside of the brain, gave rise to the false assumption that attacks with distal auras were primarily non-cerebral, has been disregarded, and most observers have arrived at the conclusion that even in these cases the first explosion is due to some cerebral cell discharge. The older views held were revolutionised by Hughlings-Jackson, who affirmed that convulsive attacks may be occasioned by over-excitability of any part of the gray matter. The production of convulsions by cortical irritation is now a very old story. The experiment of Pitres and Frank (Gaz. des Hôp., No. 38. 1883) bears upon the sensorial functions of the cortex in showing that when the cortex is irritated, epileptiform convulsions follow, but no convulsions, only definite movements, will be produced if the exposed surface be subjected to the ether spray.

As a seat of the lesion in epilepsy the medulla was given an important place by Van der Kolk and his followers; and bearing in mind the existence of the

vaso-motor centres of Dieters and the presentation of symptoms indicative of disturbance at the floor of the fourth ventricle this part of the brain is very naturally looked to by many for the most important anatomical lesions. Jackson's cortical theory of production is, however, fully in consonance with the medullary theory. If one carefully studies the attack in its different stages, it will be found that there is probably a suspension of cortical inhibition - that a derangement of the corticle cells or discharge may cause a resulting disturbance in the bulb. On the other hand, a reflex irritation through the vagus or from some distal part brings about the same disturbance of equilibrium. There is anaemia due to irritation of the vaso-motor centre, an inhibition of the great ganglion cells, and a disturbance of function of the important cranial nerves, as well as an inhibition of the great ganglion-cells. The primary anaemia and unconsciousness are accounted for by this primary irritation of sympathetic filaments and vascular constriction; the secondary hyperaemia is explained by the experiments of Kussmaul, which demonstrated the succeeding congestion; or by irritation of the spinal accessory and contraction of the muscles of the neck and compression of the large veins.

The pupillary, ocular, respiratory and other symptoms indicate the disturbance of the nerve-nuclei in the bulb. The secondary unconsciousness can be accounted for by the respiratory difficulty and the interrupted decarbonisation of the blood.

In localising the lesion in the medulla Van der Kolk (On the Minute Structure and Functions of the spinal cord, Trans. New. Syd. Soc) found capillary dilatations in the neighbourhood of the hypoglossal nuclei in tongue-biters. In epileptic patients who were in the habit of biting their tongues during the fit the vessels were wider than in those who did not bite the tongue, on an average in the course of the hypoglossus by 0.096; in the corpus olivare, which here appears to play an important part, by 0.098mm.; and in the raphe by 0.055.

Some have been of the opinion that the anaemia of the brain is not the cause of the convulsions, but that the excitation of the vaso-motor centre and that of the centre for the muscles are co-ordinate - that both go on side by side, and are independent of each other. They by this theory explain the occurrence of those forms of the petit mal in which there is loss of consciousness without convulsions, and, on the other hand, twitchings before the coma. The existence,

in Jacksonian epilepsy, of monospasms, often with a succeeding extension, is the best argument in favour of this hypothesis.

The pathological condition in those cases which are the outcome of migraine is probably an exaggerated aucto-spasm, the original impaired vascular tonus in the beginning giving rise simply to pain and lesser troubles, while after repeated change of calibre not only nutritive alterations ensue, but as well hyper-excitability of the bulbar convulsion.

So far as pathological explanation is concerned, the labours of those who have endeavoured to connect epilepsy with alterations of the cerebral tissue have been attended with nothing very definite or positive. The post-mortem appearances have varied widely, and the only conclusion to be reached is that which shows that almost any morbid gross alteration of the cerebral mass may be symptomatised by convulsions, but such a production of cerebral trouble is much more likely to be the case, and in a more definite manner, when the cortical motor centres are subject to destructive disease or irritative pressure. This is even not always the case, for numerous instances of injury to the paracentral lobe have been recorded



with no showing of resulting convulsions. The long list of autopsies in the literature show that an epilepsy may owe its origin to the pressure of a spicule of bone, or to the pressure exercised by depressed fragments of the same - to tumours or adventitious products, meningitis, cortical encephalitis, vascular degeneration, ventricular oedema, cerebral concussion, and many other morbid processes which result in rapid or slow degeneration. In such cases, of course, the genesis of the disease depends not so much upon the nature of the lesions as its location. The numerous cases collected by sundry writers show disease of the bulb or various peripheral parts which have been closely connected with the growth and behaviour of epilepsy, and the fruitful collations of cases of Jackson, Ogle and others are full of examples of limited growth or disease involving the cerebral cortex.

Sclerotic degeneration of the hippocampal convolutions have been independently and repeatedly found by several noted pathologists. Lebert and Delasiauve first observed this lesion, but since then this change has been regarded as of purely secondary, and consequently unimportant, character, by many observers.

A case of hemiplegia epilepsy with induration of the left optic thalamus and the left cornu ammonis has been reported by Tamburini (Sallanzani, Modena, 1879, viii, 1550-557) and in it aphasia existed. Pflieger (Allg. Zeit. f. Psychiatrie, etc., Berlin; 1879, xxxvi, 359-356) and Henkes have also found the sole lesion to be induration of the cornu ammonis. Of Pflieger's 43 autopsies, atrophy and sclerosis of the cornu ammonis were found twenty-five times, and the relationship of the extent of the morbid change to the violence and frequency of the seizures was also noted.

Many cases have been reported in which the autopsy disclosed hemiatrophy of the brain, especially where the disease has been found to be imilateral and associated with more or less one-side atrophy. Epilepsy has also frequently been found in association with cerebral hypertrophy, and as a symptom of cerebral tuberculosis it has long been recognised, numerous cases being reported in which for a long time the paroxysms were the only manifestations of the condition. In one of these, reported by Luy's (Arch. gén. de Méd., 1869, ii, 6141 et seq.) tubercular degeneration was found in the bulb.

Echeverria has laid great stress upon hyperplastic increase in volume of certain parts of the brain; and convulsions have frequently been noted in association with imperfect cerebral development.

As regards the morbid anatomy of the epilepsy, Marie Bra (Cited by Axenfeld) has concluded (1) The mean weight of the brain of epileptics is less than the physiological mean; (2) The cerebellum is greater than the physiological mean; (3) There frequently exists an asymmetry between the lobes (not peculiar to epilepsy); and the increase of weight is sometimes found on the right and sometimes on the left side, equality being exceptional; (4) In no form of mental disease (excepting perhaps general paresis, which is accompanied also by epileptiform crises) do we meet with so marked and constant a variation between the weights of the hemispheres as in epilepsy.

Drasche, Green, Greenhow, Löbel, and others have described cases in which tuberculous deposits were undoubtedly the cause of the disease. Kussmaul and Tenner, Hoffman and others have held that a stenosis of the superior part of the vertebral canal may explain, through pressure upon the cord, the genesis of the attack. Asymmetry of the medulla has been found by Kroon.

Indurations of different portions of the brain and medulla have been described, and especially of the olivary bodies, of the hippocampus, and of the cerebellum. These indurations have been observed on certain regions of the convolutions, in the island of Riel, etc. They show themselves in the form of patches with a grained appearance, slightly elastic, and comparable to crushed morocco leather or the surface of a cauliflower. The meninges present no alterations at the level of these lesions. These indurations have been shown to consist of a neuroglial sclerosis with integrity of the vessels and of the pia mater, and according to Chaslin, they form an evolutionary lesion, in view of the entire absence of inflammation.

Blender also found analogous lesions. Blocq and Marinesco observed this sclerosis only exceptionally; in some cases they failed to find a similar lesion, more frequently they discovered in the psycho-motor region some vascular lesions of the cells unfiltrated with granulation. Marinesco and Serieux found that the protoplasm of the nerve cells had undergone modification. Along with these patches of induration, Barthez and Rilliet, and Bourneville and Brissaud,



have described a tubercular and hypertrophic sclerosis of the brain, in which the convolutions are covered with projections and tuberosities which may be as large as a walnut. These protusions consist of essentially a sclerous tissue which may eventually destroy the vessels and nerve elements. Crocq refers epilepsy of the aged to an endarteritis of the basillar artery and its branches; and Claus and Van der Stricht consider it the result of an infectious endarteritis. When associated with general paralysis of the insane, which epilepsy often is, there will be seen rapid degeneration of the cells and fibres of the gray matter of the cortex in its cerebral lesions. It is well known that extremely varied cerebral lesions e.g., brain tumours of every kind, acute and chronic meningitis, aneurysms of the large arteries of the brain, meningeal haemorrhages, and haematoma of the dura - may cause epilepsy.

In the partial epilepsy of adults, the lesions are most frequently cortical. They are generally situated in the cortical motor area, but they may also be located outside of this zone; they then act by irritation from a distance. Consequently the topographical diagnosis of a cortical lesion productive of Jacksonian epilepsy cannot be made with certainty if

the convulsions alone are considered. The paralysis in the form of permanent monoplegia or hemiplegia, being indicative of a destructive lesion of the motor area of the opposite side, possess quite a different value from this point of view.

Although certain anatomical and clinical facts speak in favour of the sensory localisations being likewise situated in the cortex, precise data for determining the laws governing them are lacking. Bryon Bramwell observed a coarse lesion limited to the posterior extremity of the occipital cornu of the left hemisphere, in one case of sensorial discharge, consisting of flashes of red and white light in the right eye with temporary hemianopsia.

The dementia of epileptics - which, being also met with in alcoholic dementia, is not peculiar to epilepsy - has long been considered as having no characteristic lesions. Bevan Lewis and Whitwell demonstrated the existence of a degeneration of the ganglion cells of the cerebral cortex, consisting in a nuclear vacuolisation, sometimes, but not constantly associated with pigmentation.

Cicatrices of wounds or burns of the skin, especially in the face, supra orbital regions, on the frontal and parietal eminences, the external occipital pro-

tubercle, the olecranon, and the acromion, as well as sometimes consolidated fractures, and old luxations which have become irreducible, are among the lesions found at the autopsies of epileptics directly resulting from the disease by way of accidents during the paroxysms.

## S Y M P T O M A T O L O G Y.

PRODROMATA AND AURAE.

It is a fact well known that there are various minor disturbances of sensation and motion which may not amount to an epileptic attack. These may be so fugacious as to escape the attention of the persons in whose company the patient may happen to be, or he himself may be unaware of any disordered state of feeling. They may precede a severe paroxysm, when they are known as prodromata or warnings or aurae. The term aura was originally applied to the familiar premonitory sensation which is so often likened by its subject to the blowing of the wind over its skin, from whence it received its name, but it has come to be applied to all primary indications of a fit. Such aurae may be sensory or motor - in the predominance of cases the former, for motor precursors are quite rare, and when they occur are most likely to be but one stage, though slight, of the convulsion itself. There is no general rule about the occurrence of aurae, but so far as the writer's experience goes, there is a great constancy in the character of the warning in each particular case. The sensory disturbance may



vary from a vague feeling of confusion to a well-marked sensation. In many instances the patient speaks of an indescribable mental disturbance, which may precede the attack and last anywhere from a few minutes to several hours. This confusional state or psychical aura is most protean in its expression.

It may simply be a heavy feeling, a feeling of tension, a sleepy feeling, a restlessness which is manifested by the patient changing his position frequently or wandering forth in the streets; an irritability of temper which often lasts twenty-four hours or more, and during the display of which he rebukes those who may be <sup>ci</sup>solitous about him, or wantonly destroys articles of furniture, or vents his spleen upon inoffensive persons. Epileptic children have been known to bite their little brothers and sisters or their nurses. A feeling of terror sometimes precedes the attack, and very often there is a sense of impending danger which has no basis whatever, and with it is associated a depth of depression which is painful to witness. In other cases the patient exhibits a strange exhilaration, which may precede the occurrence of the attack for a period of from one ~~or~~ two hours to two or three days; and this is made manifest by great loquacity and a lively play of spirits. It is

not rare to find errors in the speech as indications of an approaching attack. A minor degree of aphasia, slowness of speech, or stuttering betrays occasionally the preparatory state which is the precursor of a severe convulsion. By far the most common warnings, however consist of disorders of the special senses, and generally these are visual. Thus the patient may see coloured lights, rings of fire, bright objects, dark spots, luminous clouds, a flood of light, sparks, stars, bright balls, lights approaching him, lights receding, fireworks, or all may seem darkness to him. While many patients are unable to define the colour perceived those who can are usually positive that it was red, and blue comes next.

In rare cases hemiopia and diplopia precede the major attacks, and are sometimes associated with dental pain and anaesthesia and with supraorbital pain as well. Among these ocular warnings one finds constriction of the visual field to be often present, especially in cases where there is a history of migraine. Vague disorders of hearing which may even amount to hallucinations, are complained of by some persons. There may be simply roaring in the ears or a sound of bells, and it may be that the patient

affirms he hears whisperings at the time of the seizure. Some patients smell smoke or other foul odours, and in exceptional instances the odour of some particular flower or of some aromatic substance, such as camphor, turpentine, or tar is perceived by the epileptic; and these are probably psychical. In some cases vertigo, palpitation, or a feeling of great suffocation, constriction of the chest or of the throat may be complained of.

Various disorders of cutaneous sensibility occur, but those auras which are of the most common occurrence are the epigastric, which consist of a vague sensation starting below the sternum and ascending, its arrival at the throat being coincident with the commencement of the fit, and the patient very often likens its culmination to the violent grasp of a strong hand. So, too, we find crawling sensations starting in the extremities and running up to the trunk. These have been compared to the contact of insects in motion or to the blowing of the wind over the surface. There may be tingling in one or two fingers or the whole hand and such sensations may be unilateral or bilateral. It is quite common for the sensory warning to begin in the hand and foot of one side and to run up to the knee and elbow. Sometimes

the tongue becomes hyperaesthetic, and the gums may become exquisitely tender just before the attack. According to Gowers, 17 per cent of his cases began with unilateral peripheral auras. Gowers says he rarely found that unilateral auras were associated with other warnings; and his experience goes to prove that unilateral sensory auras and one-sided initial motor expressions go together, and very often indicate gross organic disease. In some cases there may be for several days a decided unilateral or general weakness or recurring chronic spasms which frequently repeated. The attack may be preceded by a profuse discharge of saliva, or by epistaxis. Several authors have called attention to certain local vaso-motor disturbances which are expressed by limited patches of cutaneous hyperaemia or anaemia, so that the fingers - or, in fact, the whole hand - may either be swollen and of a dusky red colour, or, on the contrary, there may be an apparent diminution in size and blanching.

Just before the attack the patient may make more or less automatic movements, pressing his hands to his head, clasping his breast, or clutching at some imaginary objects, and after this he loses consciousness and falls to the ground. In some irregular cases the patient runs aimlessly for some distance or



describes a circle, and after a variable time, which rarely exceeds a minute or two, the actual attack begins. This disposition to running is no less remarkable than another peculiar prodroma seen in patients who begin to take off their clothing when first seized, no matter where they are or under what circumstances. This is not as has been suggested, the remains of a half-formed idea that they must seek their beds because of their impending trouble, but it is a much less complex mental act, and the patients are fully conscious when they do this, and may likewise be in places where no bed is within reach.

#### SEIZURE TYPES

Under the name of "Grand mal" classical writers describe the convulsive attacks of epilepsy and reserve the name of "petit mal" for the vertigo and mental hebitude. Such descriptions are however too schematic for the forms of attacks are innumerable. They cannot be applied to any one case in particular, but permit of <sup>a</sup> classification of the different symptoms which it is convenient to present and easy to remember.

#### THE MAJOR ATTACK. (Haut Mal; Epilepsia Gravior.)

The complete convulsion, preceded by an aura or

not comes on suddenly, consciousness and sensibility are instantly lost, and the patient falls. The fit may be divided into three stages; (1) The tonic stage or that of tetanic convulsions; (2) The clonic stage or that of irregular convulsion; and (3) the stage of stertor.

(1) The Tonic Stage.

In this stage consciousness is completely lost. At times the patient falls down with a cry as if struck by lightning; instantly and as if by a stroke he is deprived of all mental functions. This comes so quickly that he falls headlong in any attitude or place quite regardless of his surroundings. If the convulsion does not declare itself at the very same moment, he falls like a dead mass, evidently in consequence of the sudden relaxation of all the muscles. At other times the loss of consciousness comes on more gradually, as in the course of a few seconds, and the sufferer gains time enough to assume a recumbent position. Generally, however, the arrest of all mental activity takes one so by surprise that from the beginning of the seizure no recollection is retained as to the facts of the case. In deep coma every conscious sensation is wanting; and so much so that patients have sometimes fallen into the fire

and burned themselves. Even reflex processes are absent in many cases; the iris does not contract under the stimulus of light, the lids are not closed when the conjunctiva is irritated. According to Romberg, at other times the reflexes are not abolished, so that the lids close, and when water is dashed upon the body the legs are drawn up.

The tonic spasm now appears. It is of variable extent, and in the severest cases involves the whole muscular system. The eyeball is fixed, sometimes appearing to have a pronounced expression of some mental emotion, anger, etc., the countenance distorted, the jaws closed upon each other, the head drawn to one side, or backwards; there is general opisthotonus with marked extension of the extremities, - with spreading out of the fingers and toes, or also very great incurvation of the foot, - sometimes emprosthotonus ~~or even - in fact quite frequently~~ <sup>^</sup> - one half of the body shares in this with curvature in that direction, and with an alternating tendency to one or the other side; tonic contraction of the muscles of the throat, of those of respiration, - with absolute arrest of breathing, - and of the laryngeal muscles. The tonic influence, however, is not always so general and so strong; sometimes it is limited to certain groups of muscles only, sometimes

but very slightly pronounced. If it is general, certain regions may be attacked rather than others; more frequently it is first marked in the muscles moving the head and in those of the ball of the eye and face. As already stated, the tonic spasm sets in either simultaneously with the coma, or rarely somewhat later, or it may even begin a little earlier; in the latter case the scene opens with fixation of the eyeball, distortion of the face, and turning of the head. Occasionally the tonic spasm is wholly wanting, and the scene begins at once with clonic twitchings; but the opposite also occurs in rare cases, namely, the convulsive element is indicated by a tonic fixedness only, in which the rigidly extended extremities at the utmost undergo only a slight shivering movement.

The face may be seen to change colour. While some observers speak of a dark cyanotic discolouration others report pallor just as often. Both are correct both changes occur, and, in fact, generally in the same patients one after the other. On the whole, patients grow pale at the beginning of the seizure. Sometimes its approach is indicated in this way; the countenance changes before the loss of consciousness or the tonic spasm is developed; at other times



all begin at the same time. The pallor then lasts during the whole of the first stage, or is present at the very beginning only, and even before the clonic stage, has declared itself the face has already acquired a dark tint. It must be noted, however, that sometimes the hue of the face remains unchanged during the whole initial period, and at other times is dark-red from the very beginning. The latter appears to be the case particularly if just at the beginning a decided spasm of the muscles of the throat prevails with compression of the jugular veins and spasm of the glottis. The ophthalmoscope reveals in certain cases an abnormal increase in the circulation at the fundus, in others a very decided emptiness of the retinal vessels. Jackson is disposed to consider that certain visual auras depend upon spasm of the arterioles in this location. Loring, however, is not disposed to attach much importance to the ophthalmoscopic appearances, at least during the periods between the fits. The pupil is usually dilated at the commencement of the seizure.

The state of the pulse is variable. It is sometimes unaltered during the first stage and throughout the whole attack. According to some observers it is small during the tonic stage, the radial artery being

narrowed and the wave reduced. With regard to tension and regularity, the reports of various authors differ very much. It may happen that the pulse at the wrist is not felt at all, while the carotids are beating and the action of the heart <sup>is</sup> normal. Echeverria gives drawings of sphygmographic curves, according to which the pulse before the seizure was higher, distinctly dicrotic, and accelerated.

The entire stage lasts but a few seconds usually so that it may pass notice, or it may last for fifteen to sixty seconds.

(3) The clonic Stage.

This stage follows upon the foregoing. The profound unconsciousness continues wholly unchanged; but instead of the tonic muscular contraction the most violent convulsions now set in, the form of which is so well known that it is used as the type in describing analogous spasms arising from the most different sources. All the voluntary muscles of the extremities trunk, and head take part in the epileptiform twitchings. Through these are brought about in the fall seizures positions and attitudes of apparently the most impossible kind, which vary with surprising rapidity. The violence is sometimes so considerable

that the most dangerous wounds are received; fractures and dislocations have been observed, breaking of the teeth or portions of them, deep laceration of the tongue, and rupture of muscles, exclusive of the wounds and excoriations of the skin which arise from the headlong way in which the body is thrown about. Very often the clonic jerkings are interrupted one or more times by tonic spasm, so that the patient again becomes rigid; or while certain parts are undergoing violent clonic spasmodic movements, others are in a state of fixed tonicity. Even if the clonic action is very general, it may still very often be evident that one half of the body takes a more active share in it than the other. Usually, but not always, saliva shows itself at the mouth of the sufferer in the shape of foam, which may be tinged with blood from the wounds of the tongue and the buccal mucous membrane. Increased peristaltic action of the intestine occurs with rumbling in the belly and discharge of flatus and faeces, sometimes tympanitis, probably from air that has been swallowed, also ejaculation of semen, rarely vomiting, and occasionally escape of urine with considerable force.

The respiration is forcible and quickened, while

again it may be spasmodically interrupted. The consequence of this and of the violent action of the muscles is a marked venous hyperaemia. The jugulars are swollen up, the face acquires a deeply cyanotic colour, and the eyeballs protrude. Sometimes subcutaneous vessels are ruptured with the formation of ecchymoses in the skin, especially in and around the eyelids, as well as sometimes in the internal organs, yet cerebral haemorrhage forms one of the rarest accidents of an epileptic fit. The older observers speak of discharges of blood from the rectum and vagina and orbits. The pulse is now fuller than in the first stage.

This stage lasts a variable time, from half a minute to three minutes, only in exceptional cases longer, and passes into the next.

(3) The Stage of Stertor.

The convulsions now become less extensive and less frequent, and little by little they cease. Respiration becomes regular, deep and associated with sonorous rhonchi; this is the commencing stage of stertor. The patient then is in a state of profound relaxation; the limbs are placid and inert, the tendon reflexes are often abolished; the insensibility is often as



complete as during the onset. Gradually the face, which may have been red or purple, grows pale and assumes a livid blue. Respiration is noisy; the mouth filled with thick saliva, exhales a repulsive odour. A transudation, often foetid, appears on the body and face. The stage of stertor lasts for ten minutes to half an hour; rarely it is prolonged to an hour or two. Then the patient opens his eyes, casts a dull look about him, lifts his head, and rises, having as a rule, no recollection of what has passed. For the rest of the day he remains in a state of somnolence and general lassitude, and a feeling of soreness in the limbs may at the same time be complained of.

In this stage the pulse becomes gradually more quiet and full; Echeverria indeed demonstrated with the sphygmograph a decided decrease in the height of the pulse-curve during this period; it only became higher again after ten or fifteen minutes. Voisin (Ann. d'hyg. publique, 1868) April) states that the ascending branch of the wave of the pulse is higher than normal and that the curve is characterised, by a pronounced dirotism - appearances which outlast the seizure by from half an hour to several hours.

Ophthalmoscopic examinations after the fit have shown a marked hyperaemia of the fundus oculi which

may last for 24 hours.

The temperature is but seldom raised after the epileptic attack.

After the fit the quantity of urine is decidedly increased, and at the same time <sup>of</sup> a clearer colour. It is apt to contain evidence of muscular waste, and an increase in the amount of phosphates as well. Zapolsky found, however, that immediately after the attack there was a diminution in the quantity of the phosphates. The occurrence of glycosuria has been noted by several clinicians. After the paroxysm it is by no means uncommon to find the urine loaded with albumen.

#### MINOR ATTACK (Petit Mal; Epilepsia Mitior).

In the petit mal the attack usually begins suddenly perhaps while talking to the patient his expression suddenly becomes blank, the face pales, the pupils dilate, and he is evidently not conscious. In a moment or two he gathers his scattered senses, picks up the thread of the conversation and continues to unwind it. Very often he is not cognisant of any lapse of time or has a vague idea. If carefully watched for, five clonic movements may be observed in many cases, it may be of the facial muscles or of

the hands. Convulsions may occur, the dominant feature being the unconsciousness. On regaining consciousness the patient may act strangely and appear dazed; it is seldom, however, that he falls in attacks of this kind. Occasionally a peculiar dreamy state takes the place of an ordinary attack, or the individual may be the victim of imperative ideas.

A rare condition (*epilepsie larvée*), in which maniacal outbursts or explosions of passion occur, has been described by Farbet.

It has been observed but very rarely, that the patient, under an irresistible impulse, rapidly walks or violently runs for a few moments in an automatic, unconscious way, and may fall finally in a fit or may recover consciousness without an intervening convulsion; or after a fit a patient may suddenly run for some distance. Attacks of stertorous sleep have been recorded, into which the patient falls at intervals, and during which he cannot be aroused. These may alternate with convulsive attacks or be replaced by them. Attacks of generalised or localised trembling, local spasm, and salacious spasms may constitute the epileptic paroxysm.

#### NOCTURNAL EPILEPSY.

In this condition the attacks occur only during

105°30'F; the pulse becomes extremely rapid, respiration is also accelerated, and death may ensue in the midst of the convulsions. As a rule, however, the convulsions become less intense after some time; the patient remains in a condition of stertor, with limbs completely relaxed, and is insensible to irritations; the pupils continue widely dilated. During this time the temperature remains high or perhaps even rises still more and death follows. Though the status epilepticus has been known to be prolonged to eight or nine days, it seldom lasts more than two or three.

As the patient may recover, the outlook is not hopeless. In a case which promises to recover the fits become less frequent and less violent, and the temperature falls. Consciousness returns little by little, but the patient is always very slow to rise. This is because the weakness is extreme; the stupor takes a long time before it is dissipated. The loss of weight, the diminution in the proportion of haemoglobin in the blood, and all the symptoms of debility which regularly follow the attacks have reached the highest degree. The mental condition may be very seriously affected. One fact to be noted is that the status epilepticus is not necessarily con-



stituted by major attacks, but may result from a succession of incomplete seizures, vertigos, and fits of partial epilepsy. Dauchez has described disturbances accompanied by convulsions which are manifestly of an epileptic nature in a nursing infant, under the title of the subintrant syncopal state.

#### EPILEPTIC EQUIVALENTS.

Under the above designation have been described a number of sensory, sensorial, and psychical symptoms whose connection with epilepsy is demonstrated by their coexistence in the same person or in the patients family, by their essential paroxysmal course, and by the weakness which they leave behind. Quite a number of them may be considered as incomplete seizures, limited, for example, to painful or convulsive manifestations of the aura. Unless account is taken of the conditions under which they are produced, some may be mistaken for certain organic affections with which their symptoms may be identical.

#### PSYCHICAL EQUIVALENTS.

The psychical forms of epileptic equivalents are of considerable interest and importance. Instead of

epileptic attacks of the ordinary kind, or in alternation with such, or as a repeated prelude to the major convulsions, or immediately following the fits, a variety of acute mental disturbances may occur. Epileptics may unconsciously, automatically, and with apparent purpose perform a number of coördinate acts. Homicidal, obscene or pyromaniac acts may thus be done by epileptics, or intricate manoeuvres such as require the use of tools, may be accomplished. Subsequently, as a rule they have no knowledge of such acts. The precursive fit may, in a sort of status, be prolonged so that the patient may make long flights, or, in a less violent way, make journeys of several hours' or several days' duration, during which the conduct is so natural as to attract no notice. Self-consciousness usually is rather abruptly restored, and they <sup>are</sup> astonished to find themselves at a distance from home, with an intervening blank period of time. Sudden wild, maniacal outbursts, in which the patient may be destructive and dangerous to others, are encountered, and these may terminate suddenly or be protracted for several days, attended by great excitement, a high pulse and temperature, and subsequently collapse. Sometimes such attacks are

stopped by a fit, or they may succeed a severe convulsion, or they may take the place of a convulsion, or Epileptic automatism may, in a static form, last days and weeks, during which the patient conforms naturally to his surroundings. The automatic period however, usually remains a blank to him afterwards.

#### OTHER EQUIVALENTS.

These are less important perhaps than the psychical. *Augina pectoris* constitutes one of the visceral equivalents of epilepsy. Sometimes it follows, sometimes it precedes, and sometimes it coincides with epilepsy in the same patient. Moreover, the convulsive seizure may set in with a violent pain starting in the hand and extending to the neck and the precordial region. In that event the localisations of *augina pectoris* cannot be mistaken. To this painful aura the entire attack may be limited.

Some observers have endeavoured to connect with epilepsy crises of palpitations and paroxysmal tachycardia, but to render this interpretation plausible it would be necessary at least that the patients presenting the abnormal crises should have some disturbance which belongs more manifestly to the epileptic series. The same is true of certain forms of

asthma which unexpectedly affect persons in good health who are free from any pulmonary trouble. The co-existence of asthma with psychical disturbances such as hallucinations, terrors, and fear of death is, besides a well-known fact at the present time, and establishes an additional analogy between this neurosis and epilepsy. The young children, who very rarely suffer from asthma, the affection may be observed to alternate with convulsions, more or less generalised.

Spasms of the glottis may likewise be included among the incomplete seizures. The relation of this malady to infantile exlampsia has been described by Valleix and Trousseau. The symptomatic analogy with this affection is very great. Thus in spasm of the glottis the infant is seized suddenly and without prodromal symptoms, with an attack of convulsive suffocation. Respiration is suspended, the face is darkened and injected. The head is drawn backwards the mouth is wide open; the child is restless and carries its hands to its neck as if to remove the obstacle to respiration; then, after a few seconds of this dyspnoea, it makes several inspirations - whistling, sharp, and jerky - without intervening expirations; soon followed by a faint and wailing inspiration, or sometimes by a convulsive, noisy, and



jerky expiration. At the same time the extremities stiffen, the thumb is carried into the palm of the hand, the fingers being stretched or flexed on the metacarpus; involuntary evacuations take place. Most frequently consciousness is preserved, sometimes it is abolished. In one case of spasm of the glottis, observed in an adult, Brodher referred to the loss of consciousness and the consecutive drowsiness. As regards its relation to epilepsy, false croup is a convulsive manifestation to be grouped with asthma and spasm of the glottis.

Gastric disturbances, enteralgias, gastralgias, vomiting and nausea occurring suddenly and without known cause in a person free from digestive trouble, have all been included amongst the visceral equivalents of epilepsy. Nocturnal incontinence of urine is often a symptom of an attack that has passed unperceived. Trousseau has called attention to it as a premonition of a fit.

The migraines which are so common in epileptics may be considered as sensory equivalents of epilepsy. Moreau de Tours remarked that the migraines of epilepsy leave behind a profound stupor, and that they often develop and disappear with the same suddenness as the epileptic fits. Besides the connection

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between them has been admitted by various authors, Tissot and others, - and in some patients epileptic seizures recurring at similar intervals have been seen to replace a periodical migraine.

An epileptic fit by no means always follows all the above named sensorial phenomena. Thus on questioning the patients minutely we may trace in the intervals of the attack certain sensorial perversions which may consist of visual disturbances, such as clouds passing before the eye which the patients call dazzling, or else various hallucinations. Some patients see suddenly objects become immeasurably large others hear noises or voices which make them turn their heads or else perceive a peculiar odour or disagreeable taste.

#### MYOCLONUS EPILEPSY.

Epilepsy and myoclonia have, in rare instances been known to exist in the same patient, constituting the "association disease" or myoclonus epilepsy. Such cases usually show marked degeneracy, and the disease begins in early life. Epilepsy usually occurs before the myoclonia, which when once developed usually increases in severity and ends in epileptic fits.

According to Clark and Prout (Amer. Jour. of Insan-

ity, Oct., 1902) the myoclonus of Association disease is somewhat atypical compared with the essential myoclonus. The contractions are usually lightning-like, but may have a fibrillary character, involving certain parts of muscles only - a condition described as "live flesh", - and such manifestations are likely to develop into typical myoclonic contractions, though they may remain fibrillary through the life of the patient. A single general tonic contraction may rarely constitute the entire clinical picture. Myoclonus contractions end imperceptibly in the tonic stage of the epileptic paroxysm. The contractions are often strong and affect large masses of muscles, rendering locomotion difficult. The trunk is frequently affected, causing the body to jerk backwards and forwards and from side to side. Generally the myoclonus is symmetrical, but both sides are not always involved synchronously. Commonly it begins in the arms, and in a few days or weeks involves the legs, the body, neck, and face in the order given, the muscles about the eyes and mouth being the last affected. The tongue and diaphragm frequently suffer, in severe cases producing grunts and barks by contraction of the diaphragm.

As the affection develops the myoclonus becomes more and more persistent during the waking state, having a tendency to develop the myoclonic status, which may terminate in death. Usually there is a lack in mental and physical development, as well as an increase of the reflexes.

In typical cases the diagnosis is easy, and it is usually only by laying too great stress on single symptoms of the disease that mistakes are made. The lightning like contractions of the muscles of the trunk and limbs, which are not synchronous yet bilateral and not possible of production by the will, and occurring in an epileptic, should clear up any doubt which may be entertained regarding the condition.

The prognosis as regards recovery is bad. Those who are spared to advanced years usually suffer from progressive dementia and senile decay of the worst type.

#### PARTIAL EPILEPSY (Syn. Jacksonian Epilepsy).

Partial epilepsy is characterised by spasm that is generally local in character; in fact, it is always so in the beginning, though occasionally it may spread and become general. Consciousness is preserved in the milder forms. Tingling or other subjective



symptoms may precede an attack.

Partial epilepsy is seen in the acute and <sup>r</sup>chronic forms of meningitis. Syphilitis is one of the most important etiological factors, by the formation of neoplasms to which it often gives rise in the brain or in the meninges. The attacks result, therefore, from some irritation of the motor cortex, but sub-cortical lesions and certain toxaemic conditions can also give rise to it. Thus it is observed after fractures of the cranium with depression and irritation of the cerebral cortex and, therefore, constitutes an urgent and precise indication for surgical interference. Sometimes it manifests itself a long time after the injury. It may also occur in persons previously attacked by a hemiplegic or partial paralysis the result of a cerebral lesion of vascular origin. It may even be due to simple vasomotor disturbances, as in certain forms of migraine. Uraemia figures among the causes of partial epilepsy, whether it acts directly by producing local cedemas or as an exciting cause in patients with disseminated lesions of the brain and spinal cord. Finally, partial epilepsies of reflex origin have been described, whose point of origin is a peripheral irritation

acting upon the nerves of the arms. legs, trunk and of the viscera, the pleura especially. Infantile hemiplegic epilepsy deserves special mention. It may be congenital or manifest itself at a variable time after birth in persons who during infancy have suffered from convulsions followed by hemiplegia. No matter what may have been the origin of the latter, the onset of partial epilepsy is often the result of emotions, exertions, alcoholic excess, and other very ordinary causes.

The essential symptoms of partial epilepsy consist of spasm of a single group of muscles in the face, arm or leg, or other regions; no loss of consciousness, and usually sensory phenomena.

## S E Q U E L A E.

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### INJURIES.

As a result of violence we often find wounds and bruises, quite rarely fractures, but more often dislocations; thus the humerus, as a result of great muscular force may be dislocated at its superior articulation. Muscular pain of great severity, and sometimes of great persistency, follows unusually severe fits, and rupture of muscular substance is not uncommon. An epileptic olecranon bruise may produce a severe neuritis of an extremely intractable character. In old cases, according to Axenfeld, there may be great muscular hypertrophy, the sterno-mastoids attaining the size of the biceps, and in other cases there is fatty degeneration. He also calls attention to defects that may be due to frequent exercise of violence upon the bones through repeated muscular contraction. Paralysis of the nerves which supply convulsed muscles have been described, as have also tongue scars, scars of the scalp and face, burns, and haemorrhagic extravasations.

### SPECIAL SENSES.

Numerous symptoms of deficiency have been observed

in the special-sense organs, especially as regards vision and hearing.

The most varied disturbances of vision have been described, such as diminution of visual acuity, amblyopia, concentric limitation of the field of vision, defective colour perception and inability to distinguish colours at all.

Deafness sometimes follows epilepsy; impaired hearing is very common after the seizure, as are defective taste and smell. The co-existence of sensory and sensorial anaesthesia may perhaps be noted in the affected organs; for instance, deafness and anaesthesia of the auricle, amblyopia and insensibility of the lid, of the eyeball and of the rim of the orbit. This is particularly noteworthy and can be compared with similar observations in hysteria or with the sequel of cerebral lesions.

#### PSYCHICAL AND OTHER EFFECTS.

The psychical effects of epilepsy are various. For several days following the attack there may be simply confusion of ideas, irresolution, or drowsiness, which subsides in a short time. Paradoxical as it may at first sight seem, the attack may in certain individuals be regarded as an explosion of relief



when perverted mental states have preceded it, for in such persons the discharging lesion may be followed by a very conspicuous restoration of mental equilibrium. Occasionally the attacks are terminated by the commission of purposeless acts or great screaming or violence.

Aphasia or transitory disturbances of speech may appear as immediately after an epileptic fit. Sometimes it is merely an embarrassment, a hesitation in the pronunciation of words, accompanied by trembling of the tongue and lips resembling the speech disturbances in general paretics. Sometimes the disorder of articulate language is complicated with disturbances in the use of signs; the patients are unable to read. Or else it may be a temporary verbal deafness - they fail to understand what is said to them despite the evident attention they give. It is not rare to find the commission of a number of quasi-automatic actions associated with the aphasia.

Epilepsies that are unilateral are apt to leave behind them a species of paresis that may last for several days. The loss of power is confined to the convulsed members, and may be accompanied by tingling. In the great number of instances, however, the

condition is purely symptomatic of some central organic lesion.

The petit mal appears to be more decided in its remote affects than the grave disease. Slight repeated losses of consciousness are apt to be followed by mental decay. The ultimate result is mental enfeeblement, a progressive and very great loss of memory, which advances to such an extent that a veritable dementia ensues. With this there is usually a very decided perversion of the emotions and affections, so that a good natured, amiable child may in a few years become everything that is bad and trying, and commit almost unconceivable acts of mischief. Theft, incendiarism are various moral perversions and are common in chronic epileptics. Though the dementia is tardy in its appearance it comes eventually if the patient survives. In some individuals there is a very early tendency to the development of mania; there is a slight periodicity about the explosions, and when established the excitement either precedes the attack by a few days or occurs shortly afterwards. The violence is characteristically acute, and such insanity very often makes itself known in homicidal acts rather than in those of a suicidal character.

Hypochondriasis is quite likely to follow the convulsive attacks, who also occasion feelings of peculiar sadness, inferiority, and impotence. Their frequent hallucinations, the terrifying dreams to which they are very liable, render such persons timid, suspicious, and distrustful. Their tendencies often take an impulsive character; but rarely they may manifest tenacity of purpose or true energy.

#### CRANIAL AND OTHER DEFORMITIES.

Various deformities or physical defects have been described in epileptics. Thus Montpellier mentions inferiority of the facial angle; Solbrig, the narrowness and deformity of the vertebral canal. Laséque has studied the cranial asymmetry which he considered as constant in true epilepsy, and believes epilepsy to be the result of this malformation, which is affected at the period of osseous consolidation. This view includes much exaggeration. Cranio-facial asymmetry is very frequent in epileptics, but its absence does not preclude the diagnosis of epilepsy, and, moreover, it is not characteristic of this disease, for it is often observed in healthy persons. As to whether epilepsy is the consequence of this malformation or whether both result from the same

disturbance of evolution is an open question; sufficient to note that this asymmetry and epilepsy frequently co-exist. It is also of artificial production in young children from lateral decubitus. Usually the asymmetry affects the cranium and the face at the same time. The frontal eminence is less marked on one side, the parietal eminence is smaller, the orbit is less wide and not so high, and the molar bone is less prominent. The nose deviates, the facial muscles are less developed on the same side, and the lines of the face, in the absence of all paralysis, are less marked. In very pronounced cases the body of the mandible is shorter and the teeth are often badly placed on the atrophied side. The vault of the palate may be arched to a high degree. Further, ~~of one of the diameters~~ <sup>or an absolute increase</sup> we may observe either a relative increase or diminution of all of them. Finally, among the other anomalies which have been observed are; Asymmetries of the pelvis and thorax, funnel-shaped chest, unusual length of the arms and legs, relatively abnormal length of the fingers, syndactylism, etc; different colour of the two irides, asymmetry of pupils, displacement of the pupil, deformity of the auricle; anomalies of the skin, and of the genital organs.



THE GENERAL STATE.

Epileptics frequently appear healthy enough. Very often, they present gastric disturbances, a sluggish skin, and constipated bowels; but usually this is due to the bromides with which they are so often saturated. Many epileptics have gormandising tendencies and insatiable appetites. This, with the inactivity forced upon them by the disease and reinforced by the bromides, leads to flabby fatness.

## D I A G N O S I S.

GENERAL DIAGNOSIS.

To diagnose epilepsy is sometimes a matter of considerable difficulty, especially when the attacks are incomplete. The nocturnal form, for instance, may escape recognition for years. When the suspicion of epilepsy is aroused (e.g., by bed-wetting, blood upon the pillow, unexplained bruises, conjunctival ecchymoses, a dislocation or fracture occurring during sleep, cuts on the face or scalp, a bitter tongue, or some convulsive or automatic act), a careful investigation will rarely fail to disclose the nature of the disorder.

Significant would be the history of repeated momentary unconsciousness, and also that of an aura. The attack can be frequently diagnosed from other epileptoid conditions at the time by the explosive onset, the brief tonic and somewhat longer clonic spasm, profound unconsciousness followed by a deep sleep, and when these are present by an involuntary passage of urine, frothing at the mouth, and biting of the tongue, together with some of the more important symptoms already fully described.

DIFFERENTIAL DIAGNOSIS.

The one convulsive disorder more apt to be mistaken for epilepsy than any other is:-

HYSTERIA.

The following differential points will serve to distinguish between the maladies in most instances.

EPILEPSY

HYSTERIA.

- |   |  |
|---|--|
| 1. Common before puberty and rare as a recent affection after the twentieth year. | 1. Very uncommon before puberty.             |
| 2. Rarely due to emotional disturbance after the disease is established.          | 2. Often due to emotional causes.            |
| 3. Prodromes may be of any form, mental or physical.                              | 3. Emotional disturbance.                    |
| 4. Onset sudden, complete, cry, fall, rigidity.                                   | 4. Onset gradual.                            |
| 5. Consciousness instantly lost   | 5. Consciousness partially lost or retained. |
| 6. Convulsion consists of tonic, clonic, and stertorous stages.                   | 6. Epileptoid or emotional phases.           |
| 7. Two to five minutes duration.  | 7. A few minutes to several hours.           |

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|--|--|
| 8. Positions governed by flexors mainly.                         | 8. Tendency to extension, opisthotonos, crucifixion attitude, etc.   |
| 9. Pupils dilated and rigid,                                     | 9 Pupils generally mobile and active.  |
| 10. Tongue usually bitten.                                       | 10. Bitten very exceptionally.   |
| 11. Frothing of the mouth common                                 | 11. Frothing absent.   |
| 12. Sphincters usually relaxed.                                  | 12. Usually continent.   |
| 13. Pulse accelerated and tension increased.                     | 13. Rate and tension much as usual.  |
| 14. Temperature elevated 1° or 2°F.                              | 14. Temperature normal.  |
| 15. Fit terminates gradually and in hebetude.                    | 15. Somewhat prompt ending and little discomfort.  |
| 16. Urine shows increase of nitrogenous and phosphatic elements. | 16. Urea reduced, phosphates decreased, and changed phosphatic formula; often large quantity, but of low specific gravity. |



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|--|--|
| <p>17. Convulsive accidents, etc. Petechial ecchymoses, reduced muscular strength, diminished knee-jerks, mental obscuration; no recollection of attack.</p> | <p>17. No motor or reflex changes; some memory of phases of attack; usual mental condition at once regained; presence of various stigmata.</p> |
| <p>18. Restraint necessary to prevent accident.</p>  | <p>18. Restraint necessary to control violence.</p>  |

#### ALCOHOLISM.

An ordinary alcoholic debauch uncomplicated by convulsions can only be mistaken for epilepsy during the period of coma which is similar in some respects in the two conditions. The history of the case will be of vast importance in recognising alcoholism. In it the patient can usually be aroused to some extent and the breath has the peculiar alcoholic odour. Further observation of the case will usually make the diagnosis easy.

#### GENERAL PARESIS.

This may be attended with epileptiform convulsions; and, in rare instances it may coexist with epilepsy, either antedating the other. It should be remembered however, that general paresis is seldom seen before

adult life whereas epilepsy is essentially a disease of early life. Furthermore, the epileptic irritability of temper with strong impulses to violence differs very much from the good-natured placid demeanour of the paretic; and in epilepsy, the inter-paroxysmal period is usually free from evidences of disease, while in paresis this is not the case as the paretic symptoms are continuous.

#### SYNCOPE.

An attack of syncope may be mistaken for epilepsy, especially in heat-prostration, when some rigidity attends the loss of consciousness. The duration of such a state, the condition of the pulse and colour however, will easily clear up any doubts upon the part of the observer. The existence of such a cause should also be considered, and the fact that usually the epileptic paroxysm is sudden. While a feeling of depression and feebleness precedes the fainting attack, should be remembered. The points of difference may be expressed in tabular form as follows:-

#### EPILEPSY

1. Loss of consciousness sudden.

#### SYNCOPE.

1. Loss of consciousness follows a feeling of faintness.

- |   |   |
|---|---|
| 2. Period of complete unconsciousness usually short                             | 2. Unconscious throughout no convulsions.   |
| 3. The existence of aurae of a well defined type.                               | 3. The existence of preliminary vague prostration, nausea, and irregular action of the heart. |
| 4. Often involuntary discharge from the bowels and bladder.                     | 4. Quite rare or never.   |
| 5. Patient usually falls into a heavy sleep or is indifferent after convulsion. | 5. After slight weakness patient is anxious and worried, and quickly seeks relief.            |

It is however, only in cases of the petit mal that real difficulty in diagnosis is encountered.

#### TOXAEMIA.

Poisoning by lead and alcohol and certain blood states associated with kidney disease may cause epileptiform convulsions and stop short at that, or be continued into the establishment of true epilepsy - so far, at least, as clinical manifestations and ultimate results go - after the apparent removal of the primary cause. When alcohol is the cause, it is

generally sufficiently obvious; the convulsions appear after a debauch - save the relationship between cause and effect there may be nothing to distinguish them from ordinary epilepsy.

As regards uraemic convulsions, there is a previous history of renal disease which the microscope and tests will reveal, and clinically there is antecedent headache, some stupidity, and not infrequently thickness of speech and somnolence.

The convulsions of lead poisoning are usually easy to recognise; their character is established by the accompanying physical signs, such as colic, wrist-drop, blue line on the gums, and the history of the case.

#### VERTIGO.

There are light forms of auditory vertigo that may resemble vertiginous epilepsy. In the former there is never loss of consciousness, and the patient refers to the rotary character of the dizziness. In addition there will be a history of antecedent attacks, tinnitus, disease of the ear, and a certain constancy which is not a feature of the petit mal.

#### SIMULATION.

It is no very uncommon thing to find epilepsy



simulated by malingers, and sometimes the skill of the subject is so great as to even deceive the practised eye. Prisoners, soldiers, and beggars may counterfeit an epilepsy, and go through with great personal suffering to accomplish their purpose. The simulator rarely bears close watching. The dilation and contraction of the pupil cannot be simulated, nor can the corneal or pupillary insensibility. The malingerer cannot voluntarily change his colour, as is the case in true epilepsy, and, as a rule, the thumbs of the imposter are never flexed as they should be. Suggestions for a purpose are readily heard, and sometimes adopted, by the apparently unconscious man. Another valuable point of differentiation lies in the tone and degree of muscular contractions. The imposter can reproduce tonic better than clonic contractions. By firmly grasping the bare arms of the patient during the clonic period of contraction, it will be found that in genuine epilepsy the contractions are short, sharp, regular, lightning-like, and powerful in degree, as compared with those voluntarily produced by the fraud. Pressure over the supraorbital nerve causes him to wince, but has no effect upon the real epileptic.

## P R O G N O S I S.

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Epilepsy being attended by violent seizures, interfering with the social life of the patient, having serious mental sequels, and a peculiar obstinacy to remedial agents, is justly regarded as one of the severest diseases of the nervous system. The question of its curability has been much debated. Brown-Séquard most emphatically affirms that idiopathic - not inherited - epilepsy can be occasionally cured; the writer would rather suggest that perhaps they get well. Cases that are evidently symptomatic are curable if the cause can be removed.

Observers differ regarding the proportionate number of "cures". Most, however, agree that the percentage is a very small one. In general, therefore, the prognosis must be regarded as rather unfavourable.

Among the factors influencing the prognosis in special cases are: the age of the patient at the beginning of the disease, - before the twentieth year the prognosis is, other things equal, more favourable. Some regard those cases as having still better prospects which begin after the fiftieth year. All are practically agreed that the curability diminishes in the same degree with the duration of the

disease. Some authors formulate this more fully when they say that the duration in itself does not make the prognosis worse, but the number of seizures in a given time; i.e., the possibility of a cure is greater when an epileptic subject has experienced, say, twelve attacks in the year than when there have been a hundred and twenty. If there have been more than five hundred seizures, the prospect of recovery is hopeless.

Opinions are at variance with regard to the significance of very long intervals; on the whole they may be taken as favourable. Whether the attacks happen by day or night can scarcely be of importance. The character of the separate seizures, whether the *haut mal* or the *petit mal*, does not - at least in the writer's opinion - alter the prognosis with reference to curability. In view of the variety of the particular etiological influences, they are obviously of great and very different value in prognosis. Those cases have always been regarded as favourable in which a peripheral cause produces the epilepsy, for here, of course, the curability of this itself comes to be a question of first moment. But even if the condition just named exists, one must always be quite

circumspect if the epilepsy has already existed for a long time, and we cannot count implicitly upon restoration to health. Central causes render the prognosis very unfavourable. Still if one does not have to deal with material lesions, but with mental influence merely, the outlook assumes a somewhat better character. Hereditary epilepsy is esteemed incurable, Herpins and Reynolds's exceptions notwithstanding. The prognosis of epilepsy has been greatly improved since the introduction of the bromides into the therapeutics of the disease. Absolute recovery persisting ten, fifteen, and twenty years is rare, but amelioration is frequent. Psychical epilepsy is less rebellious to treatment than vertiginous epilepsy. The latter is stubborn to a high degree. A single attack of epilepsy is almost never fatal of itself, but the status epilepticus is very likely to terminate fatally, and every attack undoubtedly leaves some harmful trace. The natural termination of epilepsy is in dementia. Death may occur - besides the status epilepticus - through vascular accident, suffocation, or other physical mishap~~es~~ during a fit. Confirmed epileptics may sometimes be advantageously and profitably employed in "epileptic colonies"; the disease



may not shorten life or abridge usefulness (provided the fits are at long intervals) or negative the existence of mental qualities of a high order.

## T R E A T M E N T.

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### GENERAL TREATMENT.

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#### REMOVAL OF THE CAUSE.

This is obviously important and should, if possible be effected as a preliminary to general measures. Thus the condition of the internal organs should diligently be enquired into, especially as regards the stomach and intestines. Even in adults expulsion of worms may lead to a cure, the more likely so in children. As constipation frequently leads to a recurrence of the fits in certain persons, regulation of the bowels with mild aperients may well be instituted. In cases of auto-intoxication gastric antisepsis is advisable. As epilepsy may be the result of a diathetic malady like gout or diabetes, these should not escape attention; nor should peripheral lesions, affections of the ear and the genital organs, go neglected.

The occurrence of an epileptic fit in a person the subject of syphilis is always a serious matter. this may happen during the tertiary stage especially, and the treatment must be active as the indication is urgent. Charcot recommends the mixed treatment in large doses, in the form of mercurial inunctions of

from  $2\frac{1}{2}$  to three drachms, and iodide of potassium, 1 to 2 drachms, daily. Frequent antiseptic irrigations of the mouth should be practised to prevent stomatitis. In cases where mercury is not tolerated by the stomach recourse may be had to hypodermic injections of mercurial preparations; the injections should be deep and made in regions rich in fat, such as the dorsal and gluteal; they should, moreover, be given under rigorous antiseptic precautions; for they are very irritating and liable to cause abscesses. The treatment should be continued until the attacks cease; afterwards it may be resumed every fortnight with intervals of the same length of time. A strict attention to open air exercise, mental relaxation, etc., should be prescribed.

When the convulsions are due to traumatism involving a nerve trunk we may try revulsives, then denudation of the nerve, stretching, or section, if necessary. The chances of success will be much better the earlier the interference before the nervous system has, as it were, acquired the habit of convulsive manifestations. So, too, the removal of foreign bodies from the ear or the nose, as well as the detachment of nasal polypi, may lead to the disappearance of the fits. In temporary obstruction of the Eus-

tachian tube with compression of the labyrinth resulting from the vacuum in the tympanic cavity, insufflations of air through the tube are very effective in suppressing the vertiginous attacks which often attend auricular epilepsy. Errors of refraction must be treated on general principles, and by one specially experienced in these anomalies.

### DIET

There is no specific diet for epilepsy, and there is no form of food that can be assigned as a cause of epilepsy. The disease, however, appears to bear an important relation to the nutriment ingested, for where the diet is carefully regulated the number of attacks are usually lessened. This is particularly true of children. The indication is to give only as much food as the patient can easily digest and assimilate, and to allow sufficient time to elapse between feedings for him to utilize and excrete what he does not absorb. When this is not done, attacks may be provoked by irritating substances in the bowel, by the absorption of toxic substances from the intestinal canal, or by the accumulation of the products of metabolism in the body.

In epileptic colonies no particular diet is used



but the amount and variety of food are so regulated as to secure the best results. The following is the dietary of the Craig Colony of Epileptics, New York, and is similar to that in vogue in other institutions for the care and treatment of epileptics:-

Sunday:-

Breakfast; Eggs, Coffee, bread, butter.

Dinner; Soup, roast-beef, vegetables, corn-starch.  
pudding, custard sauce, bread.

Supper; Tea, cookies, apple sauce, bread,  
butter.

Monday.

Breakfast. Rolled oats, Coffee, bread, butter.

Dinner; Soup, mutton, potatoes, rice, pudding,  
bread.

Supper. Eggs or baked potatoes, tea, prunes,  
bread, butter.

Tuesday.

Breakfast; Stewed potatoes, Coffee, bread, butter.

Dinner. Meat-stew, potatoes, vegetables, sago-  
pudding, bread.

Supper. Corn bread or mush with syrup, tea,  
bread, butter, apple sauce.

Wednesday.

Breakfast. Rolled oats, coffee, bread, butter.

Dinner. Soup, roast-beef, mashed potatoes, vegetables, bread.

Supper. Boiled rice, crackers, cheese, tea, butter.

Thursday.

Breakfast. Eggs, Coffee, bread, butter.

Dinner; Soup, beef-hash, boiled potatoes, bread pudding bread.

Friday.

Breakfast; Rolled oats, Coffee, bread, butter.

Dinner. Soup, fresh fish (baked) or cod-fish, boiled potatoes, stewed tomatoes, gelatin pudding, bread.

Supper; Macaroni and cheese, tea, bread, butter, dried peaches.

Saturday.

Breakfast. Stewed potatoes, eggs, coffee, bread, butter.

Dinner. Irish stew, apple sauce, bread.

Supper. Hot corn bread, tea, baked potatoes, dried peaches, butter.

Vegetables used.

Potatoes, beans, peas, parsnips, celery, onions, corn, spinach, carrots, tomatoes, oyster plant.

The diet of children should consist largely of milk, and also include cereals and fruit. In older persons this diet is not advisable except as a temporary measure. For the latter meat should be allowed only once a day, unless, on account of excessive manual labour or because of a weakened condition of nutrition the patient especially requires it. Milk, cereals, bread, vegetables, and fruit should make up the rest of the dietary. Patients should be instructed to take only digestible food, in regular meals, and in moderation. They should be advised to eat slowly and masticate thoroughly. For the regulation of the diet, in a stricter sense, very positive indications are sometimes presented to us, as in pronounced anaemia and plethora.

#### Smoking.

This should be prohibited in the case of young epileptics. Adults have been known to indulge in tobacco with advantage. Cigarettes are positively injurious.

#### Marriage,

Marriage, though not actually harmful, does not improve the epileptic condition, and there is always the risk of the disease being given to the offspring.

#### Rest and Recreation.

Light, not exhausting mental efforts and the avoidance as far as possible, of emotional feelings, are essential adjuncts in treatment. It is quite wrong to forbid mental work entirely to epileptics; on the contrary, a moderate quiet exercise of the mental faculties is, as a rule very advantageous. The same is true



of physical labour; walks and simple gymnastic exercises, free from danger, are very good for patients, only they must not be carried to complete fatigue. Epileptics usually improve by making a mere change in their mode of life, where, e.g. instead of a sedentary indoor life they have taken to gardening.

#### Epileptic Colonies and Institutions.

It would be foreign to the purpose of this essay to enter fully into this question. It is fully dealt with in Letchworth's admirable work on the "Care and Treatment of Epileptics." Special "Colonies" and institutions now exist in various parts of the world, and in them the general principles above described are idealised.

The social condition of epileptics, in view of their large number (estimated as 1 to every 500 inhabitants of this country and of America), is a problem of the highest interest and importance. The distinction between dangerous and harmless epileptics is not always easy to make. It can never be asserted that a patient of this class, who has been previously quiet and inoffensive, may not become violent at any moment. A large number of these patients, even when they are exempt from mental disturbances, are obliged to give up their profession on account of their convulsive fits. Even if they are able to assist in their maintenance, they still become a charge on their family or the public. They would be sufficiently assisted if they were furnished simply the means of following their vocation at liberty in surroundings adapted to their infirmity and interested



in tolerating it. Many would be benefited by the colony plan above named. At all events they should be collected in hospitals and not in asylums. In practice a large number are nevertheless admitted to the latter; for being unable to get assistance, in hospitals rather than remain without any help they prefer to be treated as insane.

Epileptics who have frequent attacks or fits followed by mental disturbances and intellectual weakness, and those suffering from idiocy or imbecility, are properly cared for in insane asylums. In the large asylums in which such patients are numerous it is best to bring them together in a special section, for they are often a source of annoyance to other patients and quarrelsome. Violent epileptics should be placed under restraint.

#### MEDICAL TREATMENT.

##### Treatment of the Attack.

Obviously it would be of considerable importance if we were able to ward off each individual seizure. Unfortunately, this is practicable only in rare cases. It is wholly impossible in cases where the paroxysms break out suddenly; the full paroxysm may sometimes be prevented, but only in cases where some considerable time elapses prior to the loss of consciousness, and where the prodromata precede it for a length of time. This can be accomplished by having recourse to measures which are largely empirical and often employed by the

patients themselves after they have learned by experience to recognise the significance of the premonitory signs. Thus when the aura consists of a peripheral sensation, such as a cramp in an extremity, the attack can often be arrested by a constriction of the limb above the seat of the sensation. Sometimes a strong ligature is required to obtain this result, but sometimes constriction with the hand effects a similar purpose. Certain patients whose fits are preceded by a uniform mental representation may avoid the attack by concentrating their thoughts upon some other subject. Cases of this kind have been interpreted as a proof of the possible influence of the will upon epileptic discharges. In other instances the manipulation to be performed for the prevention of the attack has no bearing upon the aura, and success is obtained by a mere accident. One attack is arrested by compression of the supraorbital nerves at their points of emergence from the skull, another by the application of cold, by the ingestion of some cold liquid, by energetic whipping etc. Formerly compression of the carotids was proposed with this object but never met with favour.

Inhalations of such anaesthetics as chloroform, ether, and nitrite of amyl have been recommended for cutting short the paroxysms, but these agents, aside from the fact that their absorption is too slow to produce a useful effect may sometimes themselves provoke an attack. When the convulsions have commenced, there is

nothing, with rare exceptions that can arrest them. The only measures to be taken are those of preventing harm to the patient, such as injury and suffocation. When warned of the impending fall by the pallor of the face he should be protected as much as possible from the shock, be placed horizontally upon his back the head bent somewhat backwards, and he should be restrained in such a way that the violent and repeated movements may not result in convulsions. The clothes should be loosened, especially around the neck. The windows should be opened in order to lessen the difficulties of respiration as much as possible by a supply of pure air. Care should be taken of epileptics during the night as a considerable number of them die of suffocation during their nocturnal seizures, being strangled either by their clothes, or by pressing their face against the pillow, or perhaps by being rolled up in the bed coverings. Close supervision is, therefore, indispensable when nocturnal fits are anticipated. Death by suffocation may also occur during the muscular reaction of the stage of stertor, owing to the dropping of the tongue ~~ef the~~ upon the superior aperture of the larynx in the dorsal position. The head, therefore, should be inclined sideways so that the tongue may fall forwards by its own weight. It may be necessary to resort to artificial respiration. The sleep which follows the fit should be left undisturbed. After an attack concentrated food should be given.



Status Epilepticus. When this occurs the patient should at once be removed from every source of excitement; all noises must be shut out, the room darkened; and when the regains consciousness between the attacks movement and speaking should be prohibited. Mechanical measures for lowering arterial pressure (ligature of the lowerlimbs, large blisters, etc) may prove useful. various measures have been proposed for the status epilepticus. The bromides, even in large doses, are far from producing their usual effect in this condition. Little advantage has been derived from the use of anaesthetics, It is important to counteract the debility in this state by artificial feeding.

Drugs.-

The Bromides.-

Bromide of potassium was first specially advocated by Trousseau and Debreyne for epileptic manifestations. Some praise it as a sovereign remedy against the disease; others say they have observed scarcely more than transient benefit from it in isolated cases; the majority, however, place the drug, at all events higher than all anti-epileptics<sup>and</sup> in the writers opinion of more service than all other remedies. Some cases appear to have been cured; others resist any action of the remedy- the disease remaining entirely unchanged; a third, and this the largest number, experience a more or less marked improvement. Bromide of potassium makes the seizures less frequent, as a rule, and where they have previously been frequent, extends



the interval to several months or longer, without their then recurring in accumulated numbers or greater intensity. Even this result is of extraordinary value, in view of the frequent failure of our other remedies and measures of treatment. The arrest of the seizures sometimes coincides with the very beginning of the treatment, which is scarcely the case with any other remedy. It is true they sometimes set in again at once if the remedy is omitted; but frequently the mental disorders of epileptics undergo a decided improvement at the same time, so that patients may even return to a normal condition from a state of commencing imbecility. The mode of action of the bromide may here be passed over for it belongs to special works on pharmacology. Special emphasis on the other hand should be laid on the mode of employment. All observers are agreed as to these two points, that the remedy must be given for as long a time as possible continuously, and in large doses. In adults we begin with a drachm a day and increase to twice that amount; when there is great toleration of the drug even five drachms may be given in the twenty-four hours. It is of course, understood that there must be breaks in its administration if the well-known pathological accompaniments set in, such as disturbances of the digestion, diarrhoea, acne, and furuncles. When of great intensity they may occasionally necessitate a complete withdrawal of the remedy.

Other Bromides. The bromides of sodium, lithium, and ammonium have been used in epilepsy with good results;

The combination of several bromides is said to be productive of better results than the exhibition of any single bromide, but proof of this still remains to be furnished. Mention should also be made of the bromides of Camphor, arsenic, calcium, zinc, gold, and strontium: the last-named is the least productive of gastric disturbance. The bromides, especially that of potassium, have been frequently combined with other drugs such as belladonna, opium, and codeine; but these combinations in no way supercede the single drug.

#### Hydrotherapy.

This constitutes a valuable adjunct to the bromide treatment.

#### Electricity.

Althails was a strong advocate of this measure; he particularly advocated transverse galvanisation of the mastoid apophyses. Fischer believes in general faradisation. The galvanic current is now chiefly employed, and may be brought to bear upon the head or the sympathetic nerve. In the former case the current is passed obliquely from the frontal region to the root of the neck.

#### Serumtherapy.

Ceni (Rev. of Neurol. and Psycheat., May, 1903) believing that some toxic irritating cause, probably of a chemical nature and elaborated by the organism must be of capital import in the determination of an epileptic fit, has injected epileptics with serum derived

from other sufferers from the same disease. His experiments still require confirmation and have led to no new treatment of practical application in this disease.

### SURGICAL TREATMENT.

Sometimes brilliant results are reported in connection with trephining and other surgical measures, especially in cases of focal epilepsy. In idiopathic epilepsy removal of the motor cortex has been tried in those cases in which an aura suggested a local origin—e.g., in a centre for a particular group of muscles. The results have naturally been less encouraging than in Jacksonian epilepsy. Indeed, almost any surgical operation will diminish or check the epileptic attacks for a time. Thus simple venesection has been known to relieve a severe case for many months, and by this the results ascribed to various operations may in great part be explained. Other points in connection with this debated question are fully discussed in the surgical treatises.



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